S. J. B.

A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

(Eastern Section)

Founded 1922

Published at

LOYOLA COLLEGE

BALTIMORE, MARYLAND

VOL. XVII MAY, 1940 NO. 4

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CONTENTS

Bulletin of American Association of Jesuit Scientists

EASTERN STATES DIVISION

Vol. XVII MAY, 1940 No. 4

ANNOUNCEMENT

NATIONAL SCIENCE CONVENTION

CONTRIBUTION OF SCIENCE
TO THE QUADRICENTENNIAL CELEBRATION
OF THE SOCIETY

September 4, 5, 6, 1940

LOYOLA UNIVERSITY

6525 Sheridan Road,

CHICAGO, ILLINOIS

General Meeting, Wednesday, September 4th, 3:00 P. M.

All the Provinces in the United States are invited to attend.

California Province	Chicago Province
Maryland-New York Province	Missouri Province
New Orleans Province	New England Province
Oregon Province	

President: Rev. Richard B. Schmitt, S.J.
Loyola College, 4501 N. Charles Street,
Baltimore, Maryland.

Secretary: Rev. Emeran J. Kolkmeyer, S.J.
Canisius College, 2001 Main Street,
Buffalo, New York.

Meeting of the American Chemical Society
Detroit, Michigan; Sept. 9 to 13, 1940

NATIONAL SCIENCE CONVENTION

CONTRIBUTION OF THE SCIENCE PROFESSORS IN THE UNITED STATES TO THE QUADRICENTENNIAL CELEBRATION OF THE SOCIETY

To all Our Science Professors:

P. C.

In accordance with the wishes of Very Reverend Father General that the four hundredth anniversary of the Society be properly celebrated throughout the world, it behooves us to take part in this event by having a National Science Convention.

At the national meeting in Richmond, Virginia and Columbus, Ohio we proposed this national convention and all of Ours present gave their approval. The National Secretary of Education for the American Assistency gave his hearty approval, and in November, 1939 he communicated with all Very Reverend Fathers Provincial for their consent. Censequently at the national meeting held in Columbus on December 28, 1939, the official announcement was made that all the Fathers Provincial of the United States had given their whole-hearted approval.

The next step was to have the various Fathers Provincial appoint Ours to act on the program committee. A list of these appointments is given below.

We had received many inquiries of how this national convention will be conducted. At present, the plans are to have two general meetings, sectional meetings for Astronomy and Meteorology, Biology, Chemistry, Mathematics, Physics, Geophysics: Geology and Seismology. Then too, we plan to have one meeting open to the public on Friday evening, September 6. At this meeting we hope to have two outstanding scientists (laymen) of international reputation.

Because of this national convention the local province conventions will be omitted.

At the sectional meetings, we wish to have contributions from our Fathers and Scholastics on any modern topic of science. We expect to have many papers on all of these various topics, so we ask you to present a paper for this national convention.

At the convention we wish also to stress the historical aspects of Jesuit Scientists in the United States. If you know any of Ours who

have made Scientific discoveries in any field of science, we would appreciate it if you would give us an outline of the work done. We also desire to make a complete list of the science books that Ours have published in the United States. We consider this most important and kindly ask your cooperation.

The Program Committee as appointed by the various Fathers Provincial in the United States:

Chicago Province

Biology	Rev. Charles J. Wideman, S.J.	Loyola University
Physics	Rev. Alphonse R. Schmitt, S.J.	Loyola University
Chemistry	Rev. George J. Shipple, S.J.	University of Detroit
Mathematics	Rev. Bernard A. Hausmann, S.J.	University of Detroit
Astronomy	Rev. Joseph S. Joliat, S.J.	John Carroll University
Seismology	Rev. Victor S. Stechschulte, S.J.	Xavier University
Geology	Rev. Joseph S. Joliat, S.J.	John Carroll University

New Orleans Province

Biology	Rev. Patrick Yancey, S.J.	Spring Hill College
Physics	Rev. Carl Maring, S.J.	Loyola University
Chemistry	Rev. George Francis, S.J.	Loyola University
Seismology	Rev. Anthony Westland, S.J.	Spring Hill College

New England Province

Biology	Rev. Joseph F. Busam	Holy Cross College
Physics	Rev. John A. Tobin, S.J.	Boston College
Chemistry	Rev. Joseph J. Sullivan, S.J.	Holy-Cross College
Mathematics	Rev. Joseph T. O'Callahan	Holy Cross College
Astronomy	Rev. Thomas D. Barry, S.J.	Weston College
Seismology	Rev. Daniel Linehan, S.J.	St. Robert's Hall
Geology	Rev. Michael J. Ahern, S.J.	Weston College

Missouri Province

Biology	Rev. Paul Carroll, S.J.	Marquette University
Physics	Rev. Charles Hayden, S.J.	Creighton University
Chemistry	Mr. George Tipton, S.J.	Regis College
Mathematics	Rev. Edward Gase, S.J.	St. Louis University
Astronomy	Rev. W. C. Doyle, S.J.	Rockhurst College
Seismology	Rev. James B. Macelwane	St. Louis University
Geology	Rev. Conrad Bilgery, S.J.	Regis College

New York-Maryland Province—Northern Section

Biology	Rev. John A. Frisch, S.J.	Canisius College
Physics	Rev. John S. O'Conor, S.J.	College of St. Ignatius
Chemistry	Rev. Thomas J. Brown, S.J.	St. Joseph's College
Mathematics	Rev. John P. Smith, S.J.	Georgetown University
Astronomy	Rev. Paul A. McNally, S.J.	Georgetown University
Seismology	Rev. Joseph J. Lynch, S.J.	Fordham University

New York-Maryland Province—Southern Section

Biology	Rev. C. E. Shaffrey, S.J.	St. Joseph's College
Physics	Rev. John P. Delaney, S.J.	Loyola College
Chemistry	Rev. Richard B. Schmitt, S.J.	Loyola College
Mathematics	Rev. John P. Smith, S.J.	Georgetown University
Astronomy	Rev. Edward C. Phillips, S.J.	Woodstock College
Seismology	Rev. Fred W. Sohon, S.J.	Georgetown University
Geology	Rev. John Brosnan, S.J.	Woodstock College

Oregon Province

Physics	Rev. Francis J. Altman, S.J.	Mt. St. Michael's
Chemistry	Rev. Gerald R. Beezer, S.J.	Seattle College
Mathematics	Rev. Leo J. Yeats, S.J.	Gonzaga University

California Province

Geology	Rev. Bernard Hubbard, S.J. (by proxy)	Santa Clara University

We will communicate with each one on the Program Committee. We wish to have the titles of all the papers to be presented at the National meeting by May 15, 1940. This will give ample time for preparing papers worthy of this occasion. The convention will be held at Loyola University, Chicago, Illinois on September 4-5-6. The first general meeting will be at three o'clock on Wednesday, September 4. About a week before the convention please send a postal to Father Minister at Loyola University and give the date of your arrival, so that arrangements can be made for saying Holy Mass, and etc. This is most important and we beg your cooperation.

The following will act as Chairmen at the **Sectional Meetings** of the Science Convention:

Astronomy Section	Rev. Thomas D. Barry	Weston College
Biology Section	Rev. Patrick Yancey	Spring Hill College
Chemistry Section	Rev. George Shipple	University of Detroit
Geophysics Section	Rev. James Macelwane	St. Louis University
Mathematics Section	Rev. Bernard Hausmann	University of Detroit
Physics Section	Rev. John A. Tobin	Boston College

Rev. R. B. Schmitt, S.J.,
President.

ASTRONOMY

INTERPRETATION OF PHOTOGRAPHS OF TOTAL SOLAR ECLIPSE, CANTON ISLAND

Report of the Georgetown College Observatory Section of the National Geographical Society—United States Navy Total Solar Eclipse Expedition, Canton Island, June 8, 1937

REV. PAUL A. MCNALLY, S.J.[1]

Director, Georgetown College Observatory, Washington, D. C.

Program

1. Direct photographs—without filters—to determine the intensity, extent, and shape of the corona light.

2. Direct photographs—with a series of filters and special emulsions—to determine the intensity and extent of the coronal light in certain wide bands of wave length.

3. Spectroscopic investigation—flash and coronal spectra—in ultraviolet.[2]

Instruments

1. All direct photographs were taken with the Georgetown Col. lege observatory 3.5-inch Ross lens—63-inch focal length. The camera is mounted with the 5-inch equatorial. A weight drive was used in the field.

2. The spectograph is the one used on the National Geographic Society Stratosphere Expedition by Major Albert W. Stevens.[3]

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[1] While I realize the impossibility of anything like an adequate expression of appreciation for the generous cooperation of the National Geographic Society and the United States Navy, the organizations that made possible the eclipse expedition to Canton Island, I cannot forego this opportunity to say, in the name of Georgetown University, and in my own name, a most sincere "Thanks." The spirit that animated and actuated the many members of these two great organizations, who were associated with the work of the eclipse expedition, was most certainly caught from the spirit of their leaders, Dr. Gilbert H. Grosvenor, President of the National Geographic Society, and Admiral W. D. Leahy, Chief of Naval Operations of the United States Navy. To these two outstanding leaders, may I express my deepest gratitude.

[2] Report on the spectroscopic work is given in the paper, "Corona Spectra in the Range 4400A to 3300A."

[3] A full description of this instrument is given in National Geographic Society Contributed Technical Papers, Stratosphere Series, 2, 1936.

Material

1. The emulsion used for the first series of plates — without filters — was Eastman's Panatomic. The Eastman Company very kindly put this emulsion on plates (5x7) for the expedition.

2. The following emulsions were used for the second series of plates—those taken with filters. Eastman's spectroscopic emulsions—I-O, I-J, I-T, I-F.

A. Corning 5mm, 584 Red Ultra—Peak	3600
B. Corning 1.38mm, 511 Violet Glass Peak	4100
C. Wratten No. 12 total transmission	77.0%
at 5200	50.1
D. Wratten No. 27 total transmission	23.9
at 6100	61.9
E. Wratten Nos. 16, 35 total transmission	0.6
at 6800	40.0
F. Wratten No. 75 total transmission	1.5
at 4900	19.1

4. The following combinations of filters and emulsions were used.[4]
A and B with I-O: C with I-J: D with I-T: E and F. with I-F.

5. Plates were all standardized with the Georgetown College Observatory sensitometer. This instrument was made by Charles Ridell, instrument maker of the Yerkes Observatory.[5]

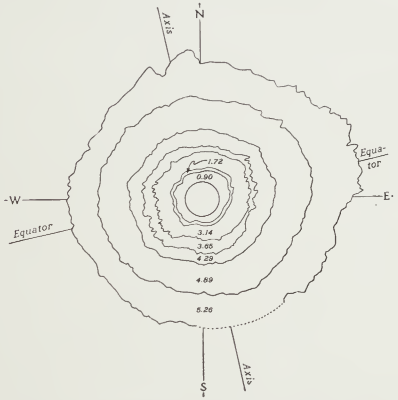

FIGURE 1—INTENSITY GRAPHS OF THE CORONA
The figures show the stellar magnitude of the successive graphs.

[4] All plates were backed by the Eastman Company.

Through the kindness of the authorities at the Mount Wilson Observatory, the stellar magnitudes of the sensitometer circles were determined from microphotometer readings—using I-B Eastman plates. The following are the values found:

1	0.00	8	2.78
2	0.50	9	3.12
3	0.75	10	3.48
4	1.21	11	3.84
5	1.61	12	4.30
6	2.02	13	4.58
7	2.42	14	4.90

The magnitude differences given in this table agree remarkably well with the magnitude differences as determinted from the sizes of the entrance holes.

Results

Only the direct photographs—without filters—have been reduced to date. The report given here, therefore, treats only of the intensity, extent, and shape of the corona as determined from a series of plates coated with the Panatomic emulsion.

Intensity and Extent of Coronal Light

Six plates were taken. The exposure times were 1, 2, 4, 8, 16, 32 seconds, respectively. Since the image of the moon is about .6 of an inch (focal length 63 inches), the corona could be photographed, on 5x7 plates, to a distance of 3½ solar diameters in one direction, and over 5 diameters in the other direction. Judging from the Georgetown eclipse plates of 1932, Freyburg, Maine (where the corona shows to a distance of 2 diameters), 5 x 7 plates were considered to be sufficiently large. 8 x 10 plates would have been better, as the corona extends beyond the edges of the plate of longest exposure.

The measurements for intensity were made with a photoelectric-cell, galvanometer combination attached to a measuring engine.[6] The light source (a 6-volt auto-headlight bulb) was fed by a storage battery. Greater uniformity was obtained in the readings by keeping

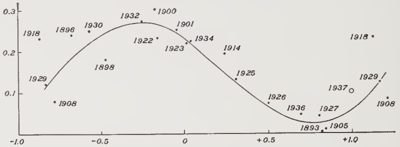

FIGURE 2—THE VALUE OF A+B ASA FUNCTION OF THE PHASE OF THE SUNSPOT CYCLE.

[6] This instrument was also used for the standardization of the photographs secured on the expedition by Dr. S. A. Mitchell, of the University of Virginia, and Dr. F. K. Richtmyer, of Cornell University, and J. E. Willis, of the Naval Observatory.

a running charger attached to the battery while the readings were being taken.

It was originally planned to measure the intensity of the corona for each millimeter of the plates. Contours could then be drawn by connecting points of equal intensity. This method was followed by King and Miss Harwood.[7] Four of the plates were measured in this way, and served as checks on the results obtained by the improved method followed later.

In accordance with the improved method, a metal table was attached to the y coordinate carriage in front of the measuring engine, and an armature extending from the eyepiece standard carried a pen or pencil. By keeping a fixed reading on the galvanometer, while the engine was being moved slowly in both coordinates, a contour of equal intensity was traced by the pen or pencil. Varying the galvanometer readings made it possible to trace a series of contours of this kind.

For the determination of the magnitudes of the contours, graphs were set up for the sensitometer circles of each plate. The ordinates in these graphs were obtained by a use of the formula:

$$\frac{D'-D}{a-D} \times 10 \qquad (1) \qquad\qquad \log\frac{a-D'}{a-D} \qquad (2)$$

(D is the reading of the galvanometer for clear plate; D′, the reading for the circle; and a, the zero reading of the galvanometer.) The abscissae, the magnitudes of the circles, were determined through the kindness of the authorities of the Mount Wilson Observatory. The galvanometer reading for the disk of the moon was taken for each plate; and a value of 4.26 magnitudes per unit area was assumed for the earth-shine.[8]

Figure 1 shows the contours as traced, with the magnitudes as read from the graph described in the previous paragraph. The values in the table below were read from a graph (ordinates = magnitudes of the contours; abscissae = distances of the contours, both in tenths of inches).

d		d	
1	0.10	8	4.00
2	1.28	9	4.25
3	2.02	10	4.43
4	2.60	11	4.58
5	3.02	12	4.68
6	3.28	13	4.75
7	3.72	14	4.82

[6] Cell—Weston, type 2, 668-3, A-3520. Galvanometer, Leeds and Northrup, No. 2500-G. The measuring engine was made by the Société Genevoise and is type CC212.

[7] Vide H. C. O. Circular 312.

[8] Vide H. C. O Circular 312.

It should be noted that the value of this table lies rather in the magnitude differences than in the magnitudes themselves. Perhaps at the next eclipse a redetermination of the earth-shine value during totality may be made, using the same equipment. Meanwhile, several other methods are being considered that may lead to an improvement of the magnitudes here given.

FIGURE 3—SHOWING CORONA MAXIMUM SUNSPOT SHAPE

The following equation gives a good representation of the magnitude = distance ratio, to a distance of three solar diameters (approximately 2,600,000 miles).

$$M = -0.982 + 1.19d - 0.089d^2 + 0.0024d^3$$

(d is in tenths of inches. One-tenth of an inch on the plates is equal to about 5′ of arc.)

Shape of the Corona

For the determination of the shape of the corona, the contours described in the previous section were used. Lines were drawn through the center of the image of the moon, causing each contour in a succession of points, 22.°5 from each other. The coordinates of these points were then measured. Using the general equation for the ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, a least square solution was made for each contour, for the determination of best values for a, b, c, and e

(a, the semi-major axis; b, the semi-minor axis; $c = \sqrt{a^2 - b^2}$; e, or eccentricity, = c/a).

The following table gives these values for the contours. No. 1 is the innermost contour.

	a	b	c	e
1	1.24	1.13	0.50	0.40
2	1.40	1.28	0.58	0.41
3	2.16	1.98	0.97	0.44
4	2,53	2.36	0.91	0.36
5	3.18	2.92	1.28	0.40
6	4.64	4.23	1.91	0.41
7	6.31	5.54	3.01	0.48

a and b are given in centimeters.

Using the formula given by Ludendorff in his excellent article,[9] e = A + B (R — 1), a value of 0.09 was found for A + B. The e of the Ludendorff formula is not the eccentricity of the ellipse, but the flattening, and is equal to $\frac{a - b}{b}$ for each ellipse. The R of the formula is equal to 2a of the ellipse, in terms of the diameter of the moon.

The phase in the sunspot cycle for the eclipse of June 8, 1937, is found from the formula: $\text{Phase} = \frac{T—M}{M—m}$ T = time of eclipse; m = time of previous minimum sunspot epoch; M = time of coming sunspot maximum. According to the Mount Wilson report,[10] the maximum following the eclipse took place in July, 1937. The previous minimum epoch was 1933.9. The phase therefore is equal to + 0.97.

Figure 2 shows the value A + B as a function of the phase of the sunspot cycle.

While the value here found fits the curve fairly well, it is felt that further examination may either improve the value, or perhaps show some connection between the shape of the corona and the variation, in the height, of the maxima in the sunspot cycle. It is worthy of note that the eclipse of 1918 followed a high maximum, while the eclipse of 1908 followed a low maximum. In the first case the value of A + B is off the curve, above; in the second case the value of A + B is off the curve, below. The 1937 eclipse was close to a high maximum; and the value of A + B is again above the curve.

A study is now in progress at Georgetown Observatory to determine which cycle—sunspot or prominence—gives the better repre-

[9] Weitere Untersuchungen über die Änderungen der Form der Sonnenkorona. Phys-Math Klasse 1934, XVI.

[10] Publications of Astronomical Society of the Pacific; vol. 50; No. 296, page 223.

sentation of the shape of the corona. It may be that a combination of the two will prove best in the end.

Ludendorff[11] is the authority for the sunspot cycle theory. From Figure 2 it will be seen that a number of the values for A + B do not fall on the smooth curve. However, they are sufficiently close to allow of a fairly accurate prediction of the shape of the corona for future eclipses. And perhaps this is the most that can be hoped for in the present investigation.

Dr. William J. S. Lockyer[12] gives four classes for the shape of the corona, connecting these with the cycle of solar prominences. They are the "equatorial," when prominences are fewest; the "intermediate up," when prominences are increasing; the "intermediate down," when prominences are decreasing; and the "polar," when prominences are at a maximum.

While it seems certain that the solar prominences have a decided influence on the shape of the corona, predictions on the shape of the corona for future eclipses, read from the solar prominence curve, do not seem to be in any way superior to those taken from the sunspot curve. Dr. Lockyer[13] gives predictions for the shape of the corona for the eclipses of 1932, 1934, 1936, 1937, and 1940, as follows:

"In the case of the next few total solar eclipses, following that of 1930, namely, those for the years 1932, 1934, 1936, 1937, and 1940, the forecasting curves suggest that the 1932 corona may be of the 'equatorial' type or on the boundary between the 'intermediate' and 'equatorial' types; that the 1934 corona will be of the pure 'equatorial' type; that the coronas of 1936 and 1937 should display an 'intermediate' type. . . ."

Actually the corona of 1932 was more elongated than the corona of 1934, hence more "equatorial." And while the corona of 1937 was of the "intermediate" type, the corona of 1936 was very decidedly of the "polar" type, according to the published report of the Czech Astronomical Association.[14]

It is hoped that a more careful examination of the two cycles—special attention being given to the number of sunspots, and to the size and position of prominences at the time of eclipse—may lead to a better knowledge of the correlation between the shape of the corona and the different forms of solar activity. In this connection it may be found necessary to evaluate the influence on the shape of the corona of flocculi and eruptive prominences, as was suggested by Bernheimer.[15]

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[11] Loco cit.

[12] Relationship between Solar Prominences and the Form of the Corona. Monthly Notices XCI, 7, p. 797.

[13] Loco cit. The article was written in 1931.

[14] No. 5, 1937—Eclipse Totale de Soleil du 19 Juin, 1936, Observée à Sara, U. S. S. R.

[15] Monthly Notices XCVIII, 7, page 598.

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Madonna of the Stars

Full half circle star trails in twelve hour exposure, 6 p. m. to 6 a. m., Dec. 10-11, '39. Camera was Premo No. 12, lens B. L. Tessar f 4.5, full aperture, no filter, Agfa Superpan filmpack $2\frac{1}{4}$ x $3\frac{1}{4}$. Camera rested on the ground ten feet in front of statue tilted to center the pole star over head. Right ascension and declination of many circumpolar stars may be measured approximately from these trails. This picture, carried by several syndicates, was published widely both in U. S. and abroad.

JOHN P. DELANEY, S.J.
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Loyola College,
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CHEMISTRY

PREPARATION OF STANDARD SOLUTIONS OF DESIRED CONCENTRATIONS

Rev. Bernard A. Fiekers, S.J.

A very practical stoichiometrical relationship, but one that is seldom encountered, is to be found in the conjunction of equation systems (1) and (2) as follows into equation (3):

$$vc = v'c' = v''c'' = k = w \qquad (1)$$

$$VC = V'C' = V''C'' = K = W \qquad (2)$$

$$\frac{VC}{v\,c} = \frac{V'C'}{v'c'} \qquad (3)$$

These are dilution equations: where V and v are volume terms; C and c, concentration terms, which may be converted to some other stoichiometrical systems by the application of the appropriate conversion factor; K and k are the constants for the given relations; and W and w are written to indicate the physical significance of the constants, viz., the weight of solute in each of the dilution systems. Equation (3) is got by dividing equation (2) by equation (1).

An application of equation (3) is possible in the dilution of a solution of but roughly known concentration to an exact desired concentration at the expense of but a single standardization procedure. O. Johnson gives the procedure for this in Ind. & Eng. Chem., Anal. Ed. 7, 76. (1935). There an illustration is given; here the underlying stoichiometry is added, and a refinement in procedure suggested.

According to Johnson, an exactly measured volume of relatively concentrated solution (about ten to twenty times the concentration desired) is diluted to a point where the new concentration would certainly be slightly less than the desired. A sample is taken from the new solution and standardized. A calculation is then made for the volume of the original solution (more concentrated) that would, under the same conditions, have produced the desired concentration. The difference between this calculated volume and the volume of "concentrated" solution actually used is then exactly measured and added to the diluted solution. The new mixture is the solution of desired concentration.

The resulting solution may be checked by standardization. Since, however, standardizations are usually performed in duplicate, the

first of the duplicates may be made, after the solution is first diluted; the second, after it is adjusted to desired concentration.

Let equation (1) represent the first dilution; and equation (2), the second. Equation (3) is then conveniently rearranged into the form:

$$\frac{V\,C}{c} = \frac{V'C'}{v'c'} \cdot v \qquad (3a)$$

Here $$C = c \qquad (4)$$
for the same solution is used in both dilution procedures. And by Johnson's supposition:

$$V' = v'. \qquad (5)$$

Thus C/c and V'/v' disappear from equation (3a), and the final form of the relationship is:

$$V = \frac{C'v}{c'} \qquad (3b)$$

In this equation, C', the desired concentration is known: c' is determined by standardization, and v is the volume of concentrated solution that was exactly measured and actually added at the start of the procedure. Equation (5) might be written:

$$V' > v' \qquad (5a)$$

Under the conditions of the procedure, equation (5) was an approximation, the volumes there being so large (circa 18 L.) that slight volume inaccuracies hardly affected the precision of the procedure.

Because of equations (5) and (5a), Johnson's method, as it stands, does not allow much of a change in procedure from the illustration he gives. In order to prepare a small volume of such a solution, for example, a method must be found that eliminates the variations in the final volume of solution. In other words, equation (5) must be rigidly applicable.

A modification which does not involve too much inconvenience is possible. The procedure is so planned that the volume of solution withdrawn for analysis, $v'a$, is less than the difference between the volumes of the original concentrated solution:

$$v'_a < (V - v) = dv \qquad (6)$$

A compensation is thus possible, and before the difference:

$$(V - v) = dV \qquad (6a)$$

is added to the solution to adjust it to the desired concentration, the difference between the members of the inequality (6):

$$dV - v'_a = dV_d \qquad (6b)$$

is accurately measured and discarded from the first approximation to the solution of desired concentration before the final adjustment is made. (In equation (6b), the subscripts a and d indicate volumes taken for analysis and discarded respectively.) Thus exactly that volume has been withdrawn from the solution for analysis and dis-

card, which will again be added to it to adjust to the desired concentration. Equation (5) becomes rigidly applicable.

The possible (relative) error refers to the concentration of the desired solution. It may be determined in the check standardization procedure. But the equation for its indirect determination gives an insight into the accuracy of the method. Rearrange equation (3b):

$$C' = \frac{V c'}{v} \qquad (3c)$$

Differentiating, etc.

$$\frac{dC'}{C'} = \frac{dV}{V} + \frac{dc'}{c'} + \frac{dv}{v} \qquad (7)$$

The error in the two volume terms is minimized, if they have a common initial reading: if, in practice, they are delivered from the same measuring vessel (e. g. burette), as a single volume to which slight adjustment is made for the final reading (two final readings). This might be possible in the preparation of very small quantities of solution. dc'/c' is the possible (relative) error of indirect measure inherent in the standardization procedure.

Taking out a sample for analysis before adjusting the solution to desired concentration entails slight error sources. These are negligible compared to the volumes of solutions in question.

The whole problem turns on one's diluting at the very beginning to a concentration point slightly less than the desired. Should the solution turn out on analysis to be more concentrated than desired, there is no method for adjusting the concentration to the desired without a new standardization procedure,—for the volume of the resulting solution is unknown.

HISTORY OF THE COLLEGE OF INDUSTRIAL TECHNOLOGY
ATENEO DE MANILA

Rev. Eugene A. Gisel, S.J., Dean

Introduction

The Philippines, like most tropical countries, is abundant in raw materials, but lacking in industries to supply even the necessities of a civilized life. Up to the present the United States has absorbed most of Philippine exports, sugar, coconut oil or copra, hemp and tobacco, and in return the Islands have imported their manufactured articles from the mother country. But on Nov. 15, 1935 the Philippine

Commonwealth was inaugurated and a definite date set for final and complete independence from the U. S., viz. July 4, 1946. On this date P. I. exports will have to meet in the American market full competition with other countries that have a much lower cost of production, with the result that Philippine export crops will be drastically curtailed, government revenue decreased, several industries wiped out, manufactured imports restricted, and the standard of living considerably lowered.

To lessen the economic shock the Philippine Commonwealth has launched on a program of industrialization, investing a considerable amount of its own revenue in major industries, and inducing private capital to put money into new manufacturing ventures. In the Fall of 1935 the Rector, Rev. Henry C. Avery, S.J., and the Faculty of the Ateneo de Manila considered how the school could help the country in the difficult period of readjustment, and it was decided that it could do nothing better in its sphere of education than to train men for the needed industries. As a result the College of Industrial Technology opened its doors in June 1936 with two courses: a four year course with majors in Food Technology, Beverages and Fermentations, Soap and Toilet Articles, Leather Tanning; and a two year course in Industrial Chemistry with majors in the same subjects, this latter with classes in the evening was meant especially for working students. In June 1939 a new course was added, a four year course leading to the degree B.S. in Chemistry.

Courses

The course, B.S. in Chemistry, is similar to that given in our colleges in the U. S. and more than fulfills the requirements of such a course as laid down by the special committee of the American Chemical Society in April 1939, not only in scientific subjects, but especially in the Humanities.

The other courses in Industrial Technology are something entirely new in the Philippines, and similar courses can be found in very few American Universities. In the U. S. new industries are begun by men who have obtained their experience in a business located in another city; in the P. I. there are no existing industries where one can obtain the necessary experience. Hence the need of a school where the modern scientific methods of a proposed industry can be learned. Hence also the need of small model factories where these methods could be practised by the student.

Curriculum

To provide for the cultural development of the student, the four year course includes: three years of Philosophy, two years of English, two years of Public Speaking, two years of Modern Language, two years of Mathematics. One year of Physics and the usual Chemistry subjects: Inorganic, Organic, Qualitative, Quantitative, Physical, Biochemistry, Advanced Organic Analysis and Synthesis. One year of

General Industrial Chemistry is taught, and the student may specialize one year each in two major industries, with Technical Analysis in conformity with his Majors.

Industrial Bacteriology, Mycology and Microbiology have an appliction to so many industries that it was thought advisable to give a two year course in these subjects with a total of 8 credits, half for lecture and half for laboratory. A one year course in Mechanical and Electrical equipment is reckoned to give the student sufficient practical familiarity with the machinery he may meet in industry. Business Management and Production Management are both taught for one year, to familiarize the student with accounting and with the conducting of a business enterprise, and with the setting up of a plant and actual production problems. Since the Philippines are immensely rich in forest products and tropical plants, a year's study and laboratory work is devoted to the possibilities of economic development of these Plant Products.

The course in Industrial Technology is undoubtedly a stiff course and requires a good deal of hard work on the part of the student to finish it in four years. Our course in Food Technology is closely modeled after one given at Massachusetts Institute of Technology, with some slight modifications due to the special conditions that exist in the Philippines; in total number of credits our course surpasses that at M. I. T. by about 15%.

Faculty

The Assistant Dean, Mr. Flaviano Yenko, Ateneo A.B. '26, specialized at the Massachusetts Institute of Technology in Food Technology and Microbiology, and teaches those subjects in addition to Leather Tanning at which he worked in the Manila Bureau of Science for 8 years. The various technology and special subjects are taught by men who have had years of experience and are at present connected either with the Bureau of Science or with important industries. A majority of the 16 lay professors have degrees from American Colleges or Universities.

Laboratories

Three one-story buildings house the laboratories, with a total of about 18,000 sq. ft. Ateneo Chemistry laboratories have always been kept as close as possible to the American standard, and are a cause of admiration on the part of visitors. The Technology laboratories contain a complete food canning plant, milk homogenizer, ice cream machine, steam jacketed kettles, a complete soft drink plant, apparatus for fermentations, a complete leather tannery, soap kettles with soap cutting table and dies, filter press, fruit press, autoclave, and steam still.

Students

There has been an encouraging response on the part of students, the enrollment having increased from 49 in 1936 to 136 in 1939. The

students come from all parts of the Philippines; in addition there are enrolled at present four from Java, three from China, and one from Guam. The Bureau of Education of Tailand (formerly Siam) after a recent inspection of our school expressed their intention of sending some students here next year.

Graduates

Of the twelve students thus far graduated (1939) from the four year course in Industrial Technology three have teaching positions in Colleges, three are with the government Bureaus of Science and Animal Industry, four are engaged in private industries, one is pursuing advanced studies in the U. S., one has joined the Philippine Army Aviation Corps.

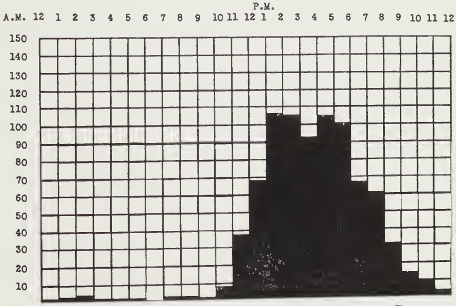
Many of the present students intend after graduation to start industries in their home towns. This is what we especially encourage, since we feel that the establishment of small industries employing modern scientific methods of manufacture is the surest and safest way to build a solid and permanent economic structure. The Philippines is primarily an agricultural country and at present derives the major part of its income from a few money crops exported mainly to the United States. After the granting of complete independence this export market will be to a great extent cut off—due to higher production costs the Philippines will not be able to compete with other tropical countries in the world market. Small industries scattered throughout the Philippines, if well-managed and producing first quality products, will not only take up the slack of unemployment, but will in addition supply the necessities and comforts of civilization that are at present mostly imported from abroad. If the Ateneo de Manila, College of Industrial Technology, can supply technically trained men for these industries, it feels that its purpose will be attained.

METEOROLOGY

SUMMER THUNDERSTORMS OVER DENVER

Anthony F. LaBau, S.J.

In Denver, Colorado, amateur weather prophets, during the summer months at least, need not employ the old moistened-finger-to-the-breeze technique or "my-rheumatism-says-so" method of forecasting. Experience has convinced the older residents of the city that they may expect a thunderstorm almost every day during June, July and August. Some of the more observant even assign a definite period for the coming of the thunder. When pressed by the curious or anxious visitor, they say quite casually that the storm will probably arrive during the early hours of the afternoon. And it does, with astonishing regularity.



Diurnal distribution of thunderstorms at Denver. The vertical scale indicates the total number of storms for each hour, 1919 to 1938 inclusive, for the months of June, July and August.

The justification of the confidence of these lay-forecasters in their predictions and their accuracy is evident from an examination of the diurnal thunderstorm records at Denver. These data for the twenty year period beginning with 1919, represented graphically in the accompanying figure, indicate that the probability of a thunder-

storm occurring once every 24 hours during the three months under consideration was 5 out of 11, or approximately 1 to 2. (Thunder occurred on 833 of the 1840 days in that period.) On the days when such a storm occurred the probability of it happening sometime in the afternoon, i. e. between noon and 6 P. M., was 5 to 7. (It came between those hours on 581 days.) The chances of it coming during the other 18 hours of the day were only 2 to 7. Note that in these calculations only the hour during which the thunderstorm began was used, hence no storm was recorded twice or in more than one hour.

Observations and studies have been made at the Denver Office of the Weather Bureau in an effort to discover the explanation of the frequency of this phenomenon during the months mentioned. To date, no completely satisfactory conclusion has been reached. However, in the April number of the **Monthly Weather Review** for last year (Vol. 67, number 4, p. 95) Mr. Albert W. Cook of the Bureau at Denver offers a very probable explanation; the thunderstorms, he suggests, are purely local in character, being influenced chiefly by the peculiar physical features surrounding the city, and hence a similar frequency will rarely occur elsewhere.

Denver is situated in the corner of a pocket formed by the main range of the Rockies, whose average altitude is more than 10,000 feet, and an east-west connecting spur known as the Palmer Lake Divide, which has an altitude of about 7,300 feet. The city, at a mile above sea level, is about 40 miles east of the Rockies and the same distance north of the spur.

The normal night-time wind at Denver is light and predominantly from the south (thereby paralleling the main range of the Rockies). In the morning the early rays of the sun fall first and longest on the mountain side, so naturally there is a greater heating there than over the lower, level Great Plain in which the city lies. Soon a flow of warm air begins to rise up the side of the Rockies. Consequently, the rising current causes an easterly breeze to come over the Plain at speeds frequently reaching 10 miles an hour. Later quite the same process takes place on the side of the connecting spur, and the low east wind becomes a northeasterly breeze blowing towards the south and west. As the morning progresses, the flow of air up the side of the mountain becomes stronger; if there is sufficient moisture in the atmosphere, cumulus clouds soon begin to appear along the mountains southwest of Denver. This usually happens about 10 A. M. By noon the cumuli have become great cumulonimbus clouds rising above the peaks, and in a very short time the fully developed thunderstorms, carried by the high winds that come across the range from the Pacific, move eastward over the Plain toward the city, 40 miles away. Rarely are the storms of any importance after they have traveled about 70 miles. The scene of their dissipation is almost always Denver and its environs.

WOODSTOCK WEATHER, PAST AND PRESENT

Arthur M. Clarke, S.J.

We have often heard it said that our modern winters and summers are far different from those we used to have, without there being, however, much chance to establish the accuracy of the statement. The recently published sixth edition of "Our Climate" for Maryland and Delaware gives us an opportunity to make the comparison. "Our Climate" is a Weather Bureau publication with special reference to local climatic conditions in the various sections of the country. Besides useful general information, it contains detailed statistics for temperature and precipitation of all kinds, giving monthly and annual averages for all the stations in its section. In the Maryland-Delaware district, Woodstock is one of the oldest co-operative stations, with a record of sixty-nine years and from the long-term summary tables given in "Our Climate" and our own records for 1938-1939, the following has been compiled.

Temperature:

	Average Mean Max. (47 yrs.)	Mean Max. 1938	Mean Max. 1939	Average Mean Min. (47 yrs.)	Mean Min. 1938	Mean Min. 1939
Jan.	42.4	42.3	42.7	23.7	23.0	24.3
Feb.	42.8	49.4	48.3	23.2	26.9	27.9
Mar.	54.4	59.3	56.2	32.1	33.2	31.5
Apr.	65.1	67.7	61.7	40.5	40.4	39.0
May	75.7	72.6	78.4	50.6	50.1	50.1
June	82.7	82.8	84.3	59.3	57.6	60.4
July	87.2	86.7	83.9	64.0	70.0	63.6
Aug.	84.4	83.8	87.3	62.4	63.4	63.6
Sep.	78.5	73.5	79.6	56.0	55.2	54.8
Oct.	67.7	68.7	66.9	43.6	40.6	43.5
Nov.	55.1	59.3	52.7	34.3	32.7	31.1
Dec.	43.8	42.8	44.7	25.9	25.9	28.0
Annual	65.0	65.7	65.6	43.0	43.3	43.2

Precipitation

	Normal (1898-1932)	1938	1939
Jan.	3.25	2.16	3.52
Feb.	2.72	2.33	3.42
Mar.	3.32	1.93	2.78
Apr.	3.32	1.64	4.84
May	3.31	4.48	0.60
June	3.98	2.97	5.35
July	4.20	3.65	2.12

Seasonal Snowfall

	Average (47 yrs.)	1937-38	1938-39
Oct.	0.1	0.0	0.0
Nov.	0.7	T	8.5
Dec.	3.8	0.3	0.4
Jan.	6.5	2.6	10.7
Feb	6.6	0.7	0.2
Mar.	4.0	4.8	0.2
Apr.	1.7	T	T

Aug.	4.49	2.04	4.12	May	T	0.0	0.0
Sep.	3.19	5.23	2.08				
Oct.	2.87	1.91	4.74				
Nov.	2.45	1.56	0.71	Seasonal:	22.4	8.4	20.0
Dec.	3.23	2.73	2.17	Annual:	1938 - 17.0		
					1939 - 17.6		
Annual	40.33	32.63	36.45				

From the above comparative tables, it is evident that except for an unusual change now and then, our temperature is much the same as it used to be. Almost month by month, the variation is constant and normal. With regard to precipitation, however, there has been an appreciable change. During 1938 and 1939 our general precipitation was six inches below normal and snowfall about five and one half inches below. A further investigation, however, shows that such variations for individual years is not uncommon. Changes in precipitation of five to eight inches from year to year are usual, while greater changes, from ten to fifteen and more inches are rather frequent. For snowfall, the contrasts are regularly even more marked. Therefore, it will be more accurate to compare whole decades. Since our oldest record of snowfall is for the year 1893, let us compare the years 1893-1902 with 1930-1939:

	Precip.	Snowfall		Precip.	Snowfall
1893	38.69	19.6	1930	20.07	18.6
1894	37.44	24.5	1931	35.59	9.7
1895	28.02	34.6	1932	45.56	16.2
1896	33.26	16.5	1933	50.06	23.5
1897	49.33	9.0	1934	46.15	31.1
1898	36.80	14.2	1935	39.53	40.5
1899	40.49	32.4	1936	39.19	22.3
1900	32.52	32.1	1937	48.69	20.5
1901	39.73	13.5	1938	32.63	17.0
1902	51.57	14.7	1939	36.45	17.6
Aver.	38.79	21.1		39.39	21.8

And a final comparison with our oldest records for general precipitation:

	1870-1879	1920-1929
Average	41.5	41.6

As a general conclusion, these statistical comparisons force us to say that the climatological conditions at Woodstock, at least, have varied very little in the course of seventy years.

NEW PUBLICATION

"Nueva Orientacion en los Estudios Ciclonicos. Naturaleza de las Rachas Ciclonicas", by Eulogio Vazquez, S. J. Editorial Hermes, Havana. 66 pp., with diagrams. (Father Vazquez studied at Massachusetts Institute of Technology from 1934 to 1936, receiving the degree of Master of Science in Meteorology from that institution. He is now Director of the Observatory of the College of Montserrat in Cienfuegos, Cuba.)

PHYSICS

DEMONSTRATIONS WITH THE CATHODE-RAY OSCILLOGRAPH

JOHN F. FITZGERALD, S.J.

Intended as a continuation of an article on this subject appearing in the May, 1939 issue of the 'Bulletin', we offer these demonstrations—suitable for the class-room or laboratory—in the hope that they may be of use to some.

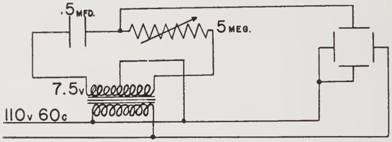


Fig. 7

8. Phase-Shifting.[1]

With the circuit of fig. 7 it is possible to develop on the oscillograph the Lissajou's figures produced by two a.c. waves of the same frequency but differing by a phase angle continuously variable between 0 and 180 degrees. cf. Plate 15.

The a.c. direct from the mains is impressed on the horizontal plates of the oscillograph, while on the vertical is put the voltage developed between the mid-point of the transformer secondary and a point between the capacitance and resistance. The phase angle in this latter circuit may be varied with respect to the former by varying the resistance—a carbon paste potentiometer (used as a variable resistance) of the type commonly used as volume or tone controls. The transformer coupling the circuits is an old radio power transformer—unmarked but evidently, from the voltage supplied, intended originally as a filament supply. Any transformer of good wave form and low secondary resistance should be suitable. For constant magnitude, the current drawn from the L, C, R circuit

[1] 'Fundamentals of Vacuum Tubes', Eastman sub Plate-current Control of Thyratrons by Grid Phase Shift. p. 212.

should be much smaller than the current flowing in that circuit—a condition which is satisfied when the load is a high resistance oscillograph.

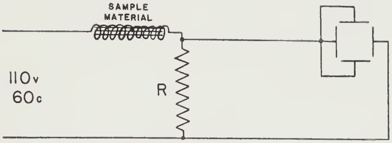


Fig. 8

9. Hysteresis Demonstration.[2]

Fig. 8. shows the circuit arrangement for obtaining the familiar hystersis loop. The solenoid, mounted horizontally atop a wooden support so that it can be placed with its end at the neck of the oscillograph, tube consists of about 140 turns of No. 18 cotton-covered wire wound on a brass form which is slotted to prevent the circulation of eddy currents. R, which provides the horizontal voltage, is a 20 ohm heater element. In operation, the oscillograph is removed from its case, connection is made to the horizontal binding posts across R, the solenoid is placed at the neck of the tube and various specimens are inserted thus providing comparative hysteresis loops. We have found that the best position for the solenoid was opposite the vertical deflection plates—the proximity depending on the deflection obtainable with the magnetic fields of the specimens used. It is advisable to connect the vertical deflection plates together to prevent stray charges building up on them. A current control, not shown in this diagram, may be required, if saturation of the various specimens used occurs at widely different current strengths.

Fig. 9

The switching arrangement used in the three following demonstrations consists of a 'closed-circuit' radio jack (fig. 9.) actuated by a cam formed by filing the armature shaft of a small battery operated motor. The outer springs are spread by a phone plug (not shown) and the two switches, S_1 and S_2 are alternately closed and opened as the cam rotates.

[2] 'The Cathode Ray Tube at Work', Rider, p. 166.

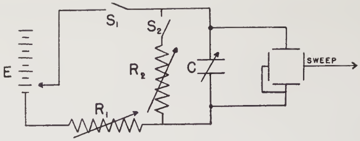


Fig. 10

10. Condenser Charge and Discharge.[3]

Using the circuit of fig. 10 the demonstrator can easily and conveniently show the charging curve of a condenser as it is connected to a source of continuous e.m.f. or the discharging curve as it is discharged through a resistance, or both, simultaneously. If the oscillograph amplifier is used, and reverses phase, interchange the connecting wires.

For C we used a General Radio Decade Condenser type 219F (1.1-0.01 μf.). Almost any easily varied resistance with a range of 0-1,000 (or more) ohms may be used for R_1 and R_2. Of course, if the equations are to be verified quantitatively, R should be a pure resistance.

To show the rise of potential, set R_2=O, thus providing an 'instantaneous' discharge. Varying R_1, C. and E permits a qualitative demonstration of the equation for rise of potential:

$$e_c = E - E\epsilon^{-\frac{t}{RC}}$$ cf. Plate 11, where $R_1 = 7{,}500$ ohms, $C = 0.81\ \mu$f. E = 6 volts.

To show the fall of potential as the condenser is discharged through a resistance, set R_1=O, thus providing 'instantaneous' charge. Varying R_2, C and E demonstrates the equation: $e_c = E\epsilon^{-\frac{t}{RC}}$ cf. Plate 12, where R_2=2,000 ohms, C=0.81 μt., E=6 volts.

Charge and Discharge curves will appear simultaneously, if R_1 and R_2 are not equal to zero. cf. Plate 10, where R_1=7,500 ohms, R_2=2,000 ohms, E and C as above.

If the equivalent of our S_1—S_2 switch is not available or not desired, a single rapidly operating switch will suffice. We have found an ordinary electric house bell satisfactory for this purpose. Removin the gong, the hammer was made to close the circuit on the power stroke by contacting the metal tip of a connecting wire held in position by a small laboratory clamp. Closing the circuit on the power stroke keeps the bell coils out of the circuit under investigation.

With this switch in position S_2 cf. fig. 10, the Charging curve

[3] cf. Morecroft, 'Principles of Radio Communication', pp. 37-40.
Gilbert, 'Electricity and Magnetism', pp. 225-226.

will appear when $R_2 = O$ ($R_1 \neq O$); the Discharge curve when $R_1 = O$ ($R_2 \neq O$). Both curves appear when R_1 and R_2 are simultaneously not equal to zero. The demonstrator may prefer to use this switch in position S_2 for the Charging curve and in position S_1 for the Discharge.

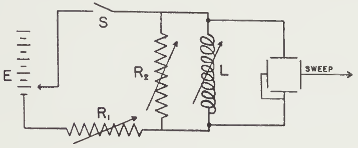


Fig. 11

11. Rise and Decay of e.m.f. in an Inductive Circuit.[4]

Substituting an inductance for the condenser in the previous circuit and omitting or shorting S_2 enables one to investigate the rise and decay of e.m.f. in an inductive circuit. For the inductance we used a Thomson Electromagnetic Coil with removable iron core having a range of about 5-6 milli-henries. cf. fig. 11.

For rise of e.m.f. set R_2 at some value, say 1,000 ohms or more, such that the decay curve is well-nigh invisible—R_2 can be disconnected but is not necessary to do so. Varying E, L (by moving the iron core) and R_1—for our coil from 0-50 ohms—demonstrates the dependence of e_L on these quantities. $e_L = E\,\epsilon^{-\frac{Rt}{L}}$

For decay of e.m.f. set $R_1 = O$ and vary R_2, L and E.

$$e_L = -E\,\epsilon^{-\frac{Rt}{L}}$$

Both curves can be made to appear simultaneously by properly choosing the values of R_1 and R_2.

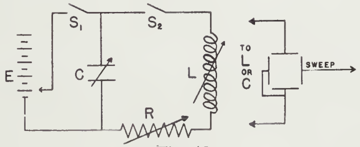


Fig. 12

12. Discharge of a Condenser through an Inductance and a Resistance.[5]

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[4] cf. Morecroft, pp. 32-35.
Gilbert, pp. 222-225.

[5] cf. Morecroft, pp. 202 sqq.
Gilbert, pp. 228-230.

The circuit of fig. 12 is arranged to show how the discharge of a condenser varies as the constants of this circuit are changed. L, C and R are the units described in demonstrations 10 and 11: L—Thomson Coil; C—Decade Condenser; R—tubular sliding resistance or volume control.

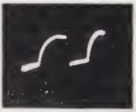
The demonstration can be begun with R well above the critical resistance: $R = 2\sqrt{\frac{L}{C}}$ giving the curve of Plate 12. As R is reduced a point is reached where the curve dips slightly below the X or 0 axis, indicating that the critical resistance has been passed and showing that the discharge is now oscillatory. Further decrease in R lengthens the wave train of damped sine waves and increases the amplitude of the initial surge according to the approximate relation:

$$e_c = E\,\epsilon^{-\frac{Rt}{2L}} \cos.\ \omega\, t. \text{ where } \omega = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}} \qquad \text{cf. Plate 13.}$$

The damping factor $\epsilon^{-\frac{Rt}{2L}}$ appears as the envelope of the wave train—the frequency of oscillation being governed by thevalue of ω i.e. $n = \frac{1}{2\Pi}\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$ which, when $\frac{R^2}{4L^2}$ is negligible compared to $\frac{1}{LC}$, reduces to the familiar $n = \frac{1}{2\Pi\sqrt{LC}}$.

If you should find, as we did, that the wave train occupies but a portion of the sweep trace, the sweep frequency can, without confusing the pattern, be doubled or, perhaps, tripled, thus spreading the

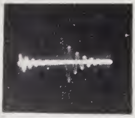
10



11

12

13



14

15

train over the screen. In this latter case, i.e. when the sweep frequency is higher than that of the switch, the trace will be clearer if

the voltage is taken across the inductance rather than across the condenser. cf. Plate 14 which shows the wave train of Plate 13—about 590 cycles per second—spread by increasing the oscillograph sweep frequency and taken from the inductance.

APPARATUS FOR LABORATORY ACOUSTICAL MEASUREMENTS

John J. McCarthy, S.J.

The apparatus to be described in the following article was designed primarily as a demonstration piece for use in undergraduate classes and as laboratory equipment for acoustical determinations. The purpose uppermost in mind was to design a device which would admit of as many acoustical measurements as possible with the same piece of apparatus. The physical principle upon which the apparatus functions is that of the resonant pipe closed at both ends. However, instead of varying the length of the pipe as is usually done to determine the nodes, the frequency is varied by means of a beat frequency oscillator and the nodes determined by means of the amplitude of the deflection of the cathode ray oscillograph.

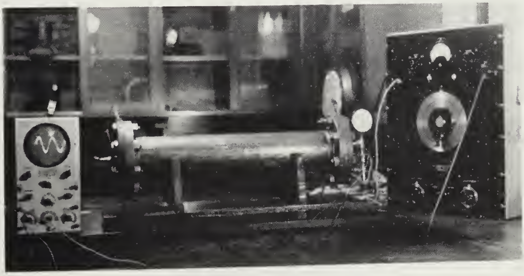


Fig. 1

The pipe is of heavy iron, about five inches in diameter and three feet long, threaded at both ends and fitted with flanges. The end plates are two heavy circular pieces of iron machined on one side to assure a close connection with the flanges to which they are fastened with eight bolts. On the inside of the end-plates equally spaced about two

inches from the center are four uprights for the purpose of holding the reflector plates and the sound source or detector as the case may be. The uprights are half-inch iron rods about six inches in length. They are threaded at one end for the end-plates and drilled and tapped at the other for the reflector plates. The end plates are drilled and tapped to receive the rods. The rods are threaded high enough to hold a nut to aid in levelling the reflector plates. The reflector plates are of brass drilled in such a way that the screws attaching them to the rods may be sunk flush with the reflecting surface. These plates were originally six inches in diameter, but they were cut down to fit the bore of the tube snugly yet not so tightly as to prevent the equalizing of pressure on both sides of the plate. Besides acting as reflectors, they also support the head-phones which are to act as the source of waves and the detector. A small hole is bored in the middle of the plate to allow the waves to pass from the source to the chamber and from the chamber to the detector. Both end-plates were drilled and tapped to receive a spark-plug which connect the source and detector with the outside, one to the oscillator and the other to the oscillograph. One lead from the phone is attached to the spark-plug and the other is grounded to the reflector plate. One head was drilled and tapped for a "T" connection, one end of which holds a guage reading pressures of thirty pounds above and below atmospheric, the other a valve which provides entrance into the tube for a pressure or vacuum pump or various gas reservoirs. The inside of the tube was painted to insure smoothness and protection against rust. The head phones attached to the reflector plates are of the crystal, pressure operated type and give a fairly constant characteristic up to 6000 cycles. All entrances into the pipe have been made through the end-plates to prevent any break in the chamber acting

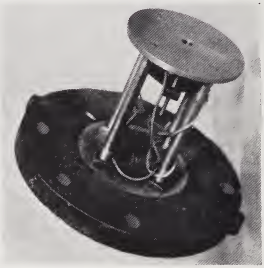


Fig. 2

as a filter. Gaskets were used in attaching the end-plates to the tube to assure an air-tight connection.

The operation of the tube is very simple. One phone is connected to the oscillator and the other to the vertical deflecting plates of the oscillograph. The oscillator generates a standing wave in the tube whose wavelength changes as the frequency is changed. When the frequency is such that the length of the tube is an integral number of half-wavelengths the oscillograph registers this fact by a deflection whose amplitude depends on the output of the oscillator and the gain of the oscillograph. For frequencies up to 6000 cycles the output of the detecting phone is sufficient to actuate the oscillograph but after that it is so small that a vacuum tube voltmeter must be substituted to determine the nodes.

Since the tube has just been completed and no exhaustive tests made, the writer cannot say how well the tube will fulfill its promise. In a few tests on the velocity of sound excellent results were obtained in the lower frequencies, using the oscillograph only. It is hoped that equally good results will be obtained in the higher frequencies, even approaching the super-sonic region. Experiments with various gases and at various pressures will be made in the near future. The tube can easily be adapted for velocity determinations at various temperatures either by immersing in a bath or by winding the tube with a heating coil. Determinations of the absorption coefficients of various materials according to the method of Taylor and Wente seem well adapted to the device and will be attempted in the near future.

STATISTICS

DO DEATHS COME IN GROUPS OF THREE?

Preliminary Communication

REV. EDWARD C. PHILLIPS, S.J.

The persuasion that deaths amongst Jesuits occur in groups of three is fairly common nor is it restricted to the Society: other organizations or special groups of persons have a similar tradition—or as some would call it, a similar superstition. It was thought worth while to examine the actual grouping of deaths amongst us as found listed in the annual Catalogues of the Maryland-New York Province for the present century.

The first question which should be settled definitely, if possible seems to be: "Just what constitutes a group of three?" The psychological element enters so strongly into a persuasion of this kind, that it is difficult to establish a definite mathematical norm. If three deaths should occur in one month after an interval of several months in which no death occurred, the impression of "grouping" would probably be quite strong: but if there were two in January, three in February; one or two in March, etc., the persuasion of "grouping" would be weak, and the February case would scarcely stand out as a special group of three. Having asked a number of Ours in several houses, what they would consider as a "group of three" in this matter, the answers varied from: "Oh, three in about one month's time" to: "three in three weeks, or three in two weeks." Other answers were non-committal. It was therefore decided to adopt a somewhat arbitrary but definite arithmetical working norm based on the statistics themselves, and the following was chosen:

During the years 1900-1939 inclusive, there were recorded 597 deaths and hence there were 596 intervals between deaths. As there were 14,610 days in these 40 years, the **average interval** (which would be the actual interval if all the deaths were equispaced) is 24.5 days; hence for equispacing the third death in any series would follow the first by 49 days, or in a period of 50 days counting both the first and the last day. If there were three deaths in half this period (and therefore other periods of approximately twice this duration were without any death) the impression of **grouping** would have some objective foundation, though perhaps not a decisive one; if however there were many cases in which three deaths occur in a

quarter or even a third of the average period, i.e. three deaths in 13 to 17 days, instead of fifty days, then there would be a solid objective reason for our impression of grouping. This latter frequency therefore was taken as our primary arithmetical norm; and the grouping in threes in half the normal period, or 25 days, was taken as a secondary or confirmative norm. It should be remarked that when three deaths are grouped in a shorter than average period, the remaining deaths must automatically be spaced at longer than average intervals, so that the psychological element of comparison of shorter periods following and proceeding longer periods is also automatically established or strengthened by each short period grouping.

From the dates of each of the deaths, the lengths of the 596 intervals were determined and are shown in Table I. This first tabulation indicates only the intervals between **two successive deaths**; it shows a surprisingly large percentage of close groupings by twos: thus out of the total of 597 intervals there are 11 of the average period of 25 days; 375 of less than 25 and only 210 of greater than the average interval.

(In this Table the first set of numbers in each double column indicates the length of the interval between two deaths and the second set the number of such intervals occurring during the 40 years. Thus we see that in 14 cases two deaths occurred on the same day (i.e. with no interval), 31 cases in which two deaths occurred on two successive days, i.e. with an interval of only one day, etc.)

Table

0	14	10	8	20	4	30	8	40	5	50	0	60-69	20
1	31	11	14	21	9	31	5	41	6	51	3	70-79	11
2	25	12	17	22	11	32	7	42	3	52	4	80-89	9
3	20	13	17	23	15	33	6	43	7	53	3	90-99	4
4	16	14	10	24	10	34	5	44	3	54	5	100-129	5
5	19	15	13	25	11	35	2	45	6	55	3	130-159	3
6	23	16	14	26	8	36	5	46	5	56	3	-	
7	18	17	16	27	8	37	4	47	5	57	2	-	
8	11	18	9	28	6	38	7	48	1	58	3	-	
9	22	19	10	29	7	39	2	49	4	59	3	-	

This table does not enable us to decide how many **groups of three** occur in any given interval. To determine this we must go back to the original series of dates and from these we find there were

68 groups of three in intervals of 17 days or less, and

28 groups of three in intervals of 25 days or less

or 90 groups satisfying the broader norm for grouping, i.e. three deaths in a period equal to or shorter than one half the average or normal interval.

It should be mentioned that in some of these groups there were more than three deaths closely following each other; in some few there were four and once or twice there were five deaths within the space of 17 days; these cases were retained on the principle that "quod abundat non vitiat". The most numerous group of rapidly

succeeding deaths occurred during an epidemic of the flu when there were ten deaths in 31 days, from September 26 to October 26, 1918. The longest interval between two deaths is that of 151 days from February 20 to July 26, 1931.

We therefore conclude that the persuasion in question has a solid foundation in fact. Out of the total of 597 deaths the maximum possible number of triplet groups is 199; as there are in fact 96 such close groups, it follows that slightly more than 48% of all the deaths occurred in groups spanning at most 25 days. The fact therefore of grouping is established; but the nature of the fact remains hidden; it is probably accidental, just as the successive occurrence of heads and tails in coin tossing is accidental, though in any long run of tosses it is highly probable that there will be as many heads as tails. We venture therefore to predict that if at the end of this century someone repeats this statistical analysis on the deaths in the second half century he will find that roughly one half of all the deaths will be grouped into threes with occasional close successions of four and a few of five deaths.

If the groupings are accidental we may expect that they will occur more or less twice a year (96 in 40 years); or at least that two in a year will be the more frequent distribution. The actual count showed the following annual frequencies:

No groups at all	in	5 of the years
Only one group	"	8
Two groups	"	11
Three groups	"	8
Four groups	"	5
Five groups	"	4
Six groups	"	1

Seven groups did not occur in any one year.

To this we may add a couple of unrelated but yet interesting data.

How are the deaths distributed in relation to the seasons of the year? Mid-winter seems to be the most fatal season. The distribution by seasons and months is as folllows:

Winter:		Spring:		Summer:		Autumn:	
158 deaths		142 Deaths		140 deaths		155 deaths	
December	41	March	50	June	44	September	49
January	56	April	50	July	51	October	50
February	61	May	42	August	45	November	56

Though February is the shortest month of the year, it nevertheless includes the greatest number of deaths, namely 61, whilst the average number would be 50 per month.

This preliminary paper was kindly read by some of our Mathematicians and they expressed the opinion that the author's treatment of the problem was not quite sound from the standpoint, or according to the principles of statistical theory. It is planned therefore to study the problem further with such helps as that theory

can provide, and to present the results of this statistical study in the Mathematical Section of the Summer Meeting of the Association. You are asked to consider this preliminary presentation of the problem as a prenote to the Summer Meeting discussions.

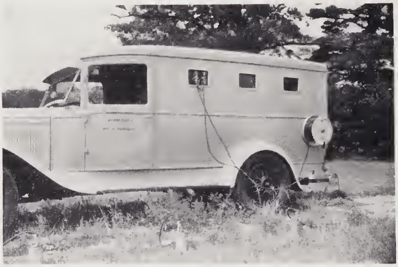
Woodstock College,
Woodstock, Md.

SEISMOLOGY

FIELD SEISMOLOGY AT WESTON COLLEGE

REV. DANIEL LINEHAN, S.J.

The first seismologist, no doubt, built his instruments with the idea that he could learn as much as possible about the mechanics of earthquakes and then begin to predict their time of occurrence to save lives and property. This double motive was handed down until recent years, and although the first part has somewhat been fulfilled, still the latter part has been practically abandoned by the seismologists. The field is still open, of course, to those who wish to exploit it and all too frequently we find pictures of some "quake-crack" in our Sunday Supplements predicting catastrophic quakes with a "Deus ex



machina" of his own design. Their moment of glory is as lengthy as the waves they blare about.

The seismologist studies the earth with his seismograph somewhat as the chemist and physicist study elements with a spectroscope. In the latter case the wave lengths of light emitted by a luminous gas are examined to determine the composition of the gas. The seismologist observes the velocity of waves through various substances to determine the nature of the transmitting substance. Ultimately, by observing reflections of the waves or their refractions, he may interpret the physical boundaries of the body. The literature is quite

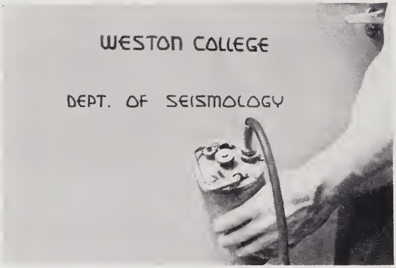
replete with studies made on the various layers of the earth and their composition.

Applying this science on a smaller scale, artificial earthquakes are produced by means of powder blasts and the use of portable seismographs. The largest application of this method has been made in the petroleum industry and every large Oil Company has its seismic crews "shooting" and determining the substructure of the lands where oil is believed to exist. American parties are working today in Europe, South America, parts of Asia and Africa not to mention the many places on our own continent. For the greater part, reflection methods are used to determine the relative depths of various strata down to depths of tens of thousands of feet. The method is quite similar to that of the sonic depth finders used on shipboard to determine the depths of water. Although refraction studies were the first in general use, this practice has almost been done away with in favour of reflection methods.

Weston College has utilized this science in New England during the past three years for studying geologic structure. Up until the present time it was necessary to borrow instruments from Harvard University for this research and in the majority of cases our departments conducted the study together. The problems have been twofold, the determination of the depth of glacial deposits over bed rocks; and again, the determination of the shape and thickness of various rock bodies.

The sounding of the depth of glacial material is a very interesting and practical problem. Prior to glacial times the New England surface presented a much different aspect than it does today. We did not have the great number of boulders in the soil that cause so much trouble to the New England farmers. Construction engineers would have to have looked elsewhere for their supply of sand and gravel as this natural resource was lacking then. The land surface was cut by

river valleys but instead of great sand banks the river cut its way through solid rock on its journey to the sea. As the glaciers melted back there was left the great mantle of deposits in the shape of eskers, drumlins, moraines and plains all composed of the material that the glacier had picked up on its journey from the north. This refuse or "till" as it is generally called, was strewn over the surface with little respect for the then present topography. Valleys were filled, river courses diverted and great sand plains deposited from the glacial rivers. The old topography was hidden. Today, geological research is attempting to uncover more of the preglacial past of New England and many of the questions concern the subsurface topography. Are many of our hills or drumlins entirely composed of gravels or do some contain a rock core? What is the exact location of the preglacial valleys? Did the Merrimack River once flow through Boston, and if so where is the old river bed? Has New



England completely risen since it was pressed down by the weight of the ice sheet? This latter problem, of course, depends on the average depth of the preglacial valleys below sea level. There are many other problems of this same kind.

From Weston we have worked on some of these problems at Cochituate and Sudbury determining the depth of a preglacial valley at several places some miles apart. The average depth of the valley there, or the depth of the till above it was about 200 feet. A supposed valley was worked near Malden and Medford where the depth of the post glacial deposits were about 40 feet and the glacial deposits in turn some 120 feet more before bed rock was encountered. On the Weston College property a large sand plain was measured to determine the amount of sand there. These measurements came to averages between 70 and 80 feet.

The advantages of seismic determination over drilling to determine depths lie in the factors of speed and certainty. The Common-

wealth of Massachusetts had already put one drill hole near our position at Cochituate, and it took them about two weeks to accomplish this at one point. The seismic profile covered several thousand yards in a single afternoon. Again the drillers might encounter a large boulder after penetrating the ground a few feet and imagine they had reached bed rock, a difficulty too often met with, but the seismic methods have no difficulty on this score. Theoretically, the seismic methods should be accurate to tenths of a foot in determining depths of this sort, but in practice there is a percentage of error amounting to about 2 or 3%.

In New Hampshire we have used reflection methods in determining the depths of great basins of rock as well as the shape of these bodies. In the summer of 1938 experiments were conducted to obtain reflections from the bottom of a large body of gneiss. This area, near Lebanon, N. H., has previously been mapped geologically by Prof. M. Billings of the Harvard Department of Geology and he suggested our using seismic methods in that location. Prof. Billings' interpretation was made from the foliation of the gneiss and he proposed the basin structure resting on a quartzitic conglomerate. It was difficult to obtain a continuous profile over the entire body or even many long profiles. This was due to the high relief and rough topography over which we could not transport our equipment. Furthermore, as this was our first attempt in determining the depth of rock structure we desired to have our blast holes in the rock we were working as well as to place the instruments on the same foundation. It was necessary to find outcrops that were sufficiently near the road for the air compressor employed for drilling. After settling all such difficulties we found that we would have to be satisfied with various separated points not on the same profile. While the depths obtained at each point were considered accurate still we could not offer a complete profile for the structure, but the series of points had to be considered satisfactory. Our results corroborated Prof. Billings' suggestion of a basin although it was a thousand feet deeper than he had originally computed. The depth near the center was approximately 4,000 feet.

Another formation similar to the above was encountered by Mr. F. Kruger of the Harvard Geological staff near Alstead, N. H. Fr. T. J. Smith and the writer worked this area during the summer of 1939. Many of the outcrops in the southern part of this basin were covered by glacial deposits and the appearances of a basin structure were not as certain as the one studied above. However, the seismic methods have proven beyond doubt that such is the formation existing there and the reflections were traced from one of the contact edges out to the center where depths of 1,300 feet were determined. On this present expedition the apparatus used was that now in the possession of Weston College. Harvard University supplied the finances to cover the living and running ex-

penses of the party. The sight of two priests conducting such experiments was quite a novelty to the natives of the New Hampshire hills, but, after a day or so of explanations and smiles everyone was quite willing that we blow up their property and many were likewise quite willing to help us drag wires and batteries cross country and through the woods.

The Weston College Department of Seismology recently became the recipient of a complete reflection outfit from The Humble Oil and Refining Company of Texas. This Company is one of the foremost in the field of geophysical research in the oil industry. The instruments were in use up to a year ago, and although they have been supplanted by instruments of more modern design, still are quite sensitive and some less so are still being used in discovering oil bearing structures. The equipment consists of a bank of six amplifiers and distributor panel, eight seismo-pickups, a recording camera with string galvanometer, reels for the pickup wires, telephones, blasting box and such accessories as well as a supply of spare parts for the equipment, consisting of tubes, condensers, transformers, resistors, etc, and about 2500 feet of photographic recording paper for the recording camera. This gift was made to Fr. M. J. Ahern through the efforts of the late Dr. Donald C. Barton, geologist for the Humble Oil Company and by Mr. D. Carlton, Geophysicist in Charge for the same Company. The instruments have been installed in the truck (once a Police Patrol) presented us by Mr. James J. Burke of Boston. The gift was mentioned in a previous issue of the Bulletin. This apparatus was used in the reflection work at Alstead, N. H., this summer.

NEWS ITEMS

WESTON COLLEGE. Seismology Department.

As soon as the ground becomes free of frost Fr. T. Smith will commence seismic surveys of the pre-glacial valley believed to exist beneath the sediments of glacial Lake Nashua. Most of the territory he hopes to survey lies within the boundaries of Camp Devens, Ayer, Mass. This study is being made with the cooperation of the Harvard University Department of Geology.

Plans are being made to undertake a series of similar surveys of the Triassic Basin in the Connecticut Valley in the States of Connecticut and Massachusetts. This will be a joint expedition between Yale University and the Weston Department of Seismology. A grant from the Geological Society of America will cover the expenses. Fr. Linehan is making the seismic measurements and Dr. Chester R. Longwell, of Yale, will map the geology. A preliminary survey is intended for the coming month of August, but the more extensive work will not begin until the Spring and Summer of 1941.

According to the Town Report of the Town of Weston, the committee in charge of the Water Supply has asked the assistance of the seismic equipment to map the substructures within the township in the hope of finding an adequate water supply for the residents. This work is also intended for the coming summer.

Fr. T. Smith, Mr. Devlin, and Mr. Langguth conducted a series of surveys along a section of Cape Cod late last year to determine the depth of the Cretaceous sediments over the Paleozoic formations. The computations have recently been finished.

Mr. Langguth constructed an isoseismal map for the Saguenay quake of October 1939. The section covered includes only those parts in the United States that were affected, and the data based upon some 350 cards and letters received from residents. Similar determinations as well as the instrumental location of the epicenter are being made by the Dominion Observatory, Ottawa, for the Canadian side of the border. Mr. Langguth's map is at present deposited with the U. S. Coast and Geodetic Survey.

Mr. Langguth has made similar studies of the Cape Cod quake of January 28th, 1940, and also for the Moodus, Conn., quakes of March 1 and 12, 1940. These latter two studies have not yet been completed.

An article of the Chelmsford, Mass., earthquake of June, 1938, will appear in the July issue of the Bulletin of the Seismological So-

ciety of America. A grant for this study was made available to Fr. Linehan by the A. A. A. S.

The results of the seismic expedition to New Hampshire last summer will appear as a joint paper by Dr. F. Kruger of Harvard University and Fr. Linehan of Weston College. Dr. Kruger mapped the geology of the area studied, the Bellows Falls quadrangle, while Fr. Linehan and Fr. Smith made the seismic surveys of a gneiss basin in the center of the quadrangle.

A joint publication of Dr. L. D. Leet, of the Harvard Seismic Station and Fr. Linehan on the pre-glacial valleys of Massachusetts is in preparation. This paper is based upon measurements made by each of the authors both from separate expeditions or where they worked in combine.

Mr. Langguth is computing new Travel Time curves for local quakes based upon data made available by Dr. L. D. Leet of Harvard. These will appear in the next issue of the North Eastern Seismological Association Bulletin (NESA). This bulletin, by the way, is prepared at Weston and the 40th number was recently published. Mr. Devlin is constructing an epicentral map of North Eastern United States based upon the findings from this bulletin.

Lectures on Seismology during the winter and spring:

Clark University, Worcester—Fr. Ahern, Fr. Smith, Mr. Devlin, and Mr. Langguth, (Each speaker chose a certain phase of the science.)

Adult Educ. Council, Boston—Fr. Ahern.

Weston College Community—Mr. James J. Dolan.

Shadowbrook Community—Fr. Linehan.

Veterans Camp, East Lenox, Mass.—Fr. Linehan.

St. Joseph's Club, Medford, Mass.—Fr. Linehan.

Department of Chemistry

In the CHEMISTRY DEPARTMENT the use of the third edition of Holmes' "Introductory College Chemistry" has been found very satisfactory as a General Chemistry text for the first year Philosophers.

"Synthetic Inorganic Chemistry" by Blanchard, Phelan and Davis, used as laboratory manual in the Inorganic course for the second and third year Philosophers, has proven to be not only very interesting but also very instructive in the study of the periodic tables.

In connection with a private study of the analysis of the rare elements, besides many micro and semi-micro accessories, Bakelite-wares, etc. a new heavy duty blast burner and an International Clinical Centrifuge were obtained.

This department is very grateful to Mrs. Frank G. Stantial, widow of the late Dr. Frank G. Stantial, for many years manager of the Merimac Chemical Company, who has donated to Weston College all the American and British Journals of her husband.

Department of Archaeology and Prehistory

In the fall of 1939, Mr. George Mahan, at the invitation of Father Ahern, lectured to the latter's class in geology on the Stone Age cultures. Representative examples of the characteristic tools of the Chellean down to the Chalcolithic cultures were selected to illustrate the talk. Over two thousand flint artifacts were brought back from the Near East by Mr. Mahan and Mr. Joseph Murphy for the anthropological collection at Weston. This collection includes coup de poings and picks of characteristic Chellean and Acheullean types from open stations around Jerusalem. Later industries are represented by Levalloiso-Mousterian points, blades and scrapers from Michmiche, an open station in the Liban near Chouer. The Middle and Upper Aurignacian types were from the Boston College Expedition's site at Ksar 'Akil, a rock shelter in the valley of Antelias located north of Beirut. This site was opened in May, 1937 by Father Joseph G. Doherty, Director, with Messrs Murphy and Mahan as staff workers. The specimens from this site include the usual range of tools found in Aurignacian cultures. Other specimens excavated by Mr. Murphy at The Cave of Antelias and L'Abri Bergy fill out the remaining periods in the Upper Paleolithic. The Neolithic culture is represented by specimens from surface finds at Nahr-el-Kelb (Dog River) above Beirut. Tahunian and Cananean specimens were found in the environs of the Jordan Valley near the Dead Sea. Finally examples of the Chalcolithic stone industry from Ghassul with characteristic chisels, gouges, awls, fan-scrapers and knives complete the collection.

Messrs. Murphy and Mahan have commenced a card catalogue of the artifacts in the collection and intend to set these tools in cabinets for the use of future students, arranged according to their cultures. Each tool will have its own catalogue number, so that adequate information on its provenance, type, flaking technique, accompanied by an exact scale drawing of the tool will always be at hand for future research.

Mr. Murphy has written several articles on some of the abovementioned sites for the Boston College Anthropological Series. The articles on Ksar 'Akil, the Boston College Expedition to the Liban should be of particular interest to Jesuit scientists.

In February, Messrs Murphy and Mahan received published copies of their archaeological work carried on under the Pontifical Biblical Institute at Teleilat Ghassul in Transjordan. The volume is divided into three parts: the first, written in German by Father Robert Koeppel, S.J., Director of the Excavations, is devoted to the stratification and a description of the rooms and various wall paintings: the pottery finds are described in the second section by Mr. Murphy; and the stone industry of the site is treated by Mr. Mahan in the third part. Both Mr. Murphy and Mr. Mahan have excellent drawings to illustrate their sections, and the majority of the photographs

were taken by Mr. Mahan. The work as a whole, gives a fine impression of scientific care and scholarship.

Department of Physics

Mr. J. F. Fitzgerald has recently completed an oscillator for use in physics experiments and demonstrations.

During the winter months a series of educational movies were shown pertaining to the field of physics. These were shown in the auditorium and the community was invited.

The Theologian's Seminar has been studying Theoretical Mechanics under the direction of Fr. T. H. Quigley and Fr. T. J. Smith.

The physics library was moved to the top floor of the Mansion this past year making available a place for study to all interested in the subject.

Mr. Devlin has devised a method whereby a photographic record may be made in determining the period of the Kater Pendulum. At present a camera once used with portable seismic equipment is employed with 35mm. film. The tuning fork in this camera allows direct reading to a 1/100 second.

LOYOLA COLLEGE, Baltimore, Md. Department of Chemistry

On March 19th, Dr. Frederick Y. Wiselogle of The Johns Hopkins University lectured to the members of the Loyola Chemists' Club on the topic: The History of Photography from the Chemists' Standpoint.

Inspector E. P. Coffey of the Federal Bureau of Investigation, United States Department of Justice lectured to the students of the Chemistry Department on the subject: Chemistry in the Detection of Crime.

The Loyola Camera Club will have a photographic contest in May. Special prizes will be awarded.

Department of Physics

Beautiful spectrograms are being obtained with the recently completed concave grating spectograph after the design of Rowland. Other instruments recently completed and now in service include a Geiger-Müller counter and a Strobotac, both of them excellent in finish and performance, the work of Mr. Regis B. Winslow, S. J.

A brief discussion by Fr. John P. Delaney, S.J. on Leonardo Da Vinci's views in line with modern Isostasy Theory has been accepted for publication in Science, and another paper entitled "Variation of Elastic Constants with Moisture Content in Soapstone" will be published by The National Research Council.

HOLY CROSS COLLEGE. Department of Chemistry

Rev. Joseph J. Sullivan, S.J., Head of the Chemistry Department, was appointed a Councillor of the Northeastern Section of the Amer-

ican Chemistry Society. Professor George J. Charest was appointed to the Membership Committee of the same organization.

On February 27th Mr. Joseph Rossettie, of Howe & French. Inc., gave an interesting demonstration of glass blowing, emphasizing the fundamental operations which should be mastered by every chemist.

On March 2nd Prof. James J. Tansey lectured before the New England Association of Chemistry Teachers, demonstrating some experiments in Colloid Chemistry.

During the Glass Blowing Seminar of March 5th, movies from the Corning Glass Works were shown which presented in detail all the operations involved in the manufacture of laboratory glassware.

On March 12th Mr. Arthur Frey of the Worcester Gas Light Co. gave a lecture demonstration before the chemistry classes showing in miniature the manufacture of water gas and carburetor water gas.

ST. PETER'S COLLEGE. Department of Chemistry

In the nine year survey conducted by the Association of American Medical Colleges, and reported lately St. Peter's had a very good record. We had the highest percentage for the State, save one.

Of a total of 39 students during the nine years, 35 had clear records.

Among the speakers before the Collins Chemistry Society this year were Dr. Robert J. Moore, of the Bakelite Corporation, and Dr. Martin H. Ittner, of the Colgate-Palmolive-Peet Company.

BOSTON COLLEGE. Department of Chemistry

The chemists club was started last year, but was not fully organized for activity until this year. Under the guidance of Fr. Anthony Carroll, S.J., the club has developed a real enthusiasm. Several prominent chemists have addressed the group at the regular meetings, and many of the club members have joined in plant inspection trips to local chemical or manufacturing plants. Recently the officers of the club were guests of the Northeastern Section of the A. C. S. at one of the monthly dinners, and a large group of club members attended the lecture at M. I. T. after the dinner. At the present time the club is interested in three projects,—glass blowing, photography, and lecture demonstrations. A battery of six blast burners was set up, and once a week at scheduled two hour periods groups of six students have the opportunity of practicing the fundamental operations of glass blowing under the direction of Fr. Albert F. McGuinn, S.J. The course is planned for ten weeks. The photography and lecture demonstration projects are being handled by Fr. Carroll, the club director.

The chemistry curriculum has undergone some minor changes,

and it may be of interest to give a brief summary of the courses, as the present sophomores will have them.

1st year	Inorganic	2 semesters	
2nd year	Qualitative	1 semester	
	Quantitative	1 semester	
3rd year	Organic	2 semesters	
	Physical	2 semesters	
4th year	Qualitative Organic Analysis		1 semester
	Advanced Quantitative Analysis		1 semester
	Biochemistry		1 semester
	Elective Chemistry		1 semester

In the large classes of Freshman Inorganic Chemistry and Junior Cultural Chemistry we have used the chemical kit system in the laboratory this year for the first time. The kits were made up by us and proved to be rather inexpensive. The experience of one year involved no great difficulties, and because of obvious advantages we plan to continue this method of dispensing chemicals. We have used the kit system in the semi micro qualitative analysis for the past two years, and can report satisfactory results with the semi micro tèchnique and the kits used in the course.

We have plans to begin a course in micro organic analysis next fall for the graduate students, and have acquired for that purpose a new Becker Semi-Micro Balance.

The chemistry department was recently inspected by a representative of the American Chemical Society who will make his report to the Committee on the Professional Training of Chemists. It is expected that a list of approved colleges will be published soon.

Last Fall an effort was made to organize the graduates of the Boston College Chemistry Department, and the move was enthusiastically received by the alumni whom we could reach by mail. A large group attended the first meeting in the department laboratories and plans for a permanent organization were drawn up. During the winter this group had a dinner at the Hotel Lenox in Boston, and at the present writing all plans are laid for a dinner at the College with an expected attendance of forty members. Mr. Harold Fagan, a member of the chemistry staff for many years, was chosen as Secretary of the new organization.

Department of Physics

The thirty students who took the Civilian Pilot Training Ground School here passed the C.A.A. Final Examinations with an average of 84.3 for all examinations in the Ground School. Rev. John A. Tobin, S.J., the Director of Civilian Pilot Training received a flight training scholarship from the Civil Aeronautics Authority.

Two laboratory experiments were found helpful in the Senior course. The filtration of sound by a Helmholtz resonator was obtained by sending known frequencies from a Beat-Frequency Oscil-

lator (General Radio Type 713 B) through a headphone into a long tube with and without a side arm. We used the tube that is found in the coefficient of expansion apparatus. The sound is detected by a microphone and the energy is read on a milliammeter. The difference in milliamperes between the tube without the arm and with the arm represents the filtration of that side arm. Another experiment was given to calibrate the optical pyrometer. A black body furnace was constructed from a wooden box filled with asbestos. In the center is a firebrick cylinder with thermocouple ends at the center. The heating element is a platinum ribbon around the center. The theremocouple is platinum and platinum rhodium calibrated. The optical pyrometer is focused on the center and can be calibrated from the thermocouple.

Department of Biology

The following science projects are being carried on at present in the biology department of Boston College: Study of regeneration in Lumbricus, and Turbellaria, the use of the heart of the Quahaug, Venus Mercenaria as a test for Acetylcholine, and the effects of muscle extracts in stimulating this heart, the effects of salts on the Venus heart, study of various digestive enzymes in the clam worm Nereis, study of regeneration of nerves in the common frog, Rana pipiens.

It may be of some interest that in connection with the study of the heart of the quahaug, excised hearts have been kept beating for a period of three days, and some hearts which inadvertently were frozen solid, regained normal beats on being placed at room temperatures.

The heart of the common quahaug, Venus mercenaria, is a very sensitive indicator of small amounts of Acetylcholine. The heart is excised and kept in a glass perfusion chamber. Sea water which is very close in ionic composition to the body fluids of the animal is used for the perfusion medium. When acetylcholine in concentrations as small as 1×10^{-18} is added to the perfusion fluid the heartbeat is decreased in amplitude, and larger amounts cause the heart to stop in diastole. Adrenaline and potassium cause the heart to stop in systole. Eserine in the concentrations used had no effect upon the heart. Since acetylcholine is liberated at the endings of parasympathetic nerves, a sensitive and accurate test for this substance would be of some value for physiological research.

INISFADA COLLEGE. Department of Physics

Inisfada has recently become the recipient of a gift consisting of a number of Weston, Rawson and General Electric A.C. and D.C. volt and ammeters, as well as a motor-generator set for 110 A.C. to 110 D.C. conversion.

The value of the equipment received is approximately $500 and constitutes a much needed addition to our electrical laboratory.

Among the meters is a Weston electrodynamometer type volt-

meter, Model 341 which has just been calibrated and found to be accurate to better than ¼ of one percent full scale value of 150 volts. This meter can therefore be used as a very satisfactory secondary reference standard for both A.C. and D.C. voltage measurements.

Dr. Conway, mentioned in the Fordham University Chemistry Department news items of the last BULLETIN, presented his demonstration lecture on General Chemistry to the Inisfada community on February 28.

All his apparatus, including lecture table, is supplied from his so-called "laboratory on wheels" which consists of a specially designed trailer fitted with the necessary compartments.

FORDHAM UNIVERSITY. Chemistry Department

Rev. Francis W. Power read a paper at the meeting of the Local Section of the American Chemical Society held at the Pennsylvania Hotel on April 5th. Father Power also presented an address at the annual Spring meeting of the American Chemical Society at Cincinnati, Ohio, to the Microchemistry section.

Dr. Hermann O. L. Fischer of the University of Toronto was guest speaker at the Chemistry Department Seminar on March 6th, his subject being the optically active glycerides and glycerophosphates.

Dr. F. F. Nord recently addressed the seminar of Northwestern University Medical School and the Chicago Section of the American Chemical Society. On the same trip he also gave a talk to the members of the research staff of Seagram's at Louisville, Ky.

Rev. Francis W. Power, S.J. recently addressed the Physical Chemistry Seminar at Brooklyn Polytechnic Institute on the application of statistics to analytical problems.

Mr. Joseph Alicino addressed the Metropolitan Michrochemical Society on an improved method for sulphur using the micro bomb.

Dr. Leopold Cerecedo discussed chemical methods for the assay of vitamin B_1 before a research group at Mt. Sinai Hospital.

Department of Physics

The Physics Department will again have an exhibit at the World's Fair. This time the exhibit will be housed in the Hall of Science and Education and will occupy about one third more space than that of last year. A section of the exhibit will be devoted to amateur seismology. Arrangements have been made with the Grace Line for the installation under the supervision of Dr. Hess of a Cosmic Ray counter on one of their boats plying between New York and Chile. Readings will be taken of Cosmic Ray intensities throughout the trip to determine the variation with latitude.

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INDEX TO VOLUME XVII, 1939-1940